

551.506 (73)

## DETAILS OF THE WEATHER IN THE UNITED STATES.

## GENERAL CONDITIONS.

By ALFRED J. HENRY, Meteorologist.

Monthly mean pressure was higher than normal along the northern boundary from North Dakota eastward; it was below normal in the North Pacific Coast States, the northern Plateau and Rocky Mountain region, and in the Ohio Valley. This pressure distribution was reflected in the mean temperature of the month and in the distribution of precipitation. The temperature along the northern boundary was lower than normal from the St. Lawrence Valley westward to Montana; positive departures obtained quite generally south of the fortieth parallel, the greatest being the Gulf States. Thus the change from almost continuous positive temperature departures having begun in the North, it may be expected that the change will progressively overspread the South. Precipitation was in excess of normal in Washington, Oregon, Idaho, and Montana in the West and in the Ohio Valley in the East; it was also in excess, although to a less extent, in the Lake region, the Middle Atlantic, and New England States. Deficient precipitation was recorded in the lower Mississippi Valley and from the Central Plains States westward and southwestward to California.

The first general storm of the winter type passed from the Pacific onto the continent on the 19th. This storm was characterized by heavy snow, sleet, and rain in North Pacific Coast States, with the usual interruption to transportation and traffic in general. The heavy snowfall in Washington and Oregon provided a much-needed supply of soil moisture. During the closing days of the month a severe snow, sleet, and rainstorm visited New England, the details of which appear elsewhere in this REVIEW, p. 612. The storm movement of the month as a whole was close to that of a normal November. Further details follow:

## CYCLONES AND ANTICYCLONES.

By W. P. DAY, Observer.

Migratory high and low pressure areas showed great activity during November and many important ones were charted. Energetic storms from the North Pacific passed inland at lower latitudes than during the preceding month and the point of ingress of the Pacific HIGHS was also shifted southward. The more important HIGHS were of the Alberta type and nine pulses or invasions were noted, which is more than the average number of all types for this month. The winter Plateau HIGHS also began to make their appearance.

Tables showing the number of HIGHS and LOWS by types follow:

LOWS.	Al- berta.	North Pa- cific.	South Pa- cific.	North- ern Rocky Moun- tain.	Colo- rado.	Texas.	East Gulf.	South At- lantic.	Central.	Total.
November, 1921.	6.0	9.0		2.0	1.0	2.0	1.0	2.0	2.0	25.0
Average number, 1892-1912, in- clusive.	4.0	2.3	0.6	0.1	1.1	1.0	0.4	0.8	1.0	11.6

  

HIGHS.	North Pacific.	South Pacific.	Al- berta.	Plateau and Rocky Moun- tain Region.	Hudson Bay.	Total.
November, 1921.		2.0	3.0	9.0		14.0
Average number, 1892-1912, in- clusive.		2.0	0.9	4.0	1.1	8.2

## THE WEATHER ELEMENTS.

By P. C. DAY, Climatologist and Chief of Division.

## PRESSURE AND WINDS.

In the United States November as a rule shows only a slight increase in the number of cyclones and anti-cyclones over those occurring in October. During November, 1921, however, both these atmospheric disturbances were greatly augmented over those for October, and more than twice the usual number for November was observed. However, few of these disturbances attained great importance, or maintained their maximum intensity over extensive paths.

The most severe storm of the month from the standpoint of property loss was that of the 27th to 29th, over the Atlantic coast districts. (See page 612 of this REVIEW.) This storm was attended by widespread precipitation over the more eastern districts of the United States, and by high winds along the middle Atlantic and southern New England coasts. Over northern districts precipitation was in the form of snow, but in portions of southern New England the temperature was sufficiently low to cause the rain to freeze as it fell, and all exposed objects were covered with ice. The accumulation of this ice was so great that overhead wire systems of all description were practically destroyed, and communication, light, and power operations were greatly interrupted. Orchards and forests, however, suffered the greatest permanent injury, the extent of which is indicated in the following extracts from the official report of the Weather Bureau observer at Hartford, Conn.:

It is estimated that more damage was done by this storm than has been done by all the storms of the preceding 50 years. At any rate, the storm may be favorably compared with the now famous, so-called "Portland" storm in 1898. Conditions in the sections of the State mentioned were most distressing, because everywhere there were evidences of many acres of forest that were ruined, while shade and ornamental trees and shrubs, together with apple orchards, are almost totally destroyed. Stands of oak, maple, and ash have been leveled to the ground, while birches have been bent over and held down so long they can not straighten up. A tangle of broken branches covers the forest floor, and when it dries it will make a serious fire menace. Numerous light and power plants and wires were destroyed, resulting in dark towns and villages. Telephone and telegraph poles were leveled by the hundreds, and thousands of miles of wires were broken and tangled. These, however, are relatively easy to replace and repair, but the farmers and orchardists received a blow from which it is hard to recover. In many cases orchards were just beginning to bring profits and are now helpless for a period of at least 15 years. Because of the crippled condition of high-tension wires, factories were compelled to suspend operations. Public-service corporations in Hartford had practically normal service, but the service rendered by outside points was severely hit. It is impossible to estimate the money value of the various losses, though it must run into many millions in the aggregate.

The most important anticyclones of the month dominated the northern and eastern districts from the Rocky Mountains to the Atlantic coast from the 18th to 23d, during which period the lowest temperatures of the month generally occurred in the region affected.

The average pressure for the month was above normal along the northern border from the Missouri Valley eastward, in the far Southwest, and over the Canadian Provinces as far north as indicated by observations. Pressure was below normal over most central and southern districts from the Great Plains eastward and in the Rocky Mountains and far northwestern districts.

The general trend of the winds was from northerly points over the Missouri and upper Mississippi Valleys, the Great Lakes region, Atlantic coast, and east Gulf sections. They were mainly from the south in the lower

Mississippi Valley and southern Great Plains, and variable in other portions of the country.

The highest winds of the month were observed along the north Atlantic coast on the 29th, in connection with the severe cyclone passing off the southern New England coast on that date. Other high winds were confined usually to small areas.

#### TEMPERATURE.

The month was mainly free from unusual cold or warmth, though the maximum temperatures at a few points were the highest of record for the month, and minimum temperatures were quite low in the far West on the 18th and 19th.

The principal cold period of the month began on the 18th, when high pressure from the Canadian northwest moved into the Missouri Valley, and low temperatures prevailed for several days over central and northern districts from the Rocky Mountains eastward.

The first week of the month was decidedly warm over all districts from the Great Plains westward to the Pacific coast, and moderately warm over the Mississippi Valley, Gulf States, and along the south Atlantic coast. It was mainly cool in the Lake region, Ohio Valley, and North Atlantic States. The second week continued warm in the far West, and over considerable areas in the South, but it was decidedly cool over practically all central and northern districts from the Rocky Mountains eastward. The third week was decidedly cold over the northern border States from the upper Lakes westward to Washington and Oregon, and it was mainly cooler than normal over much of the remaining Mountain, Plateau, and Pacific coast areas. From the southern plains eastward and northeastward to the Atlantic coast this week was mostly warm.

The final week of the month was warmer than normal over practically all central and southern districts east of the Rocky Mountains, and over all districts to the westward. Along the northern border from Montana eastward this week was distinctly cooler than normal.

The principal warm periods were during the first six days over the western half of the country, the temperature on the 3d being unusually high in portions of the Plateau region. Over the eastern half of the country the period from the 17th to 19th was the warmest, on which dates maximum temperatures at a few points were as high as or higher than had previously been observed so late in the month.

The coldest weather was confined mostly to two periods. Over the districts including the middle and lower Mississippi Valley and thence eastward, the lowest temperatures occurred very generally from the 11th to 13th, while over all far western districts, the Missouri and upper Mississippi Valleys, and upper Lakes region they were observed from the 18th to 20th. The lowest temperature recorded during the month,  $-42^{\circ}$ , occurred in Montana, and zero temperatures or lower were reported from all the States along the northern border, and in most of the western mountain districts.

November, 1921, brought to a close an unusually long period with average monthly temperatures above the normal over portions of the upper Mississippi Valley and Great Lakes region, where this condition has existed for many months. In other portions of this region the means were again above normal, making the fifteenth consecutive month with average temperatures above the normal, and the longest such period in the history of the Bureau.

#### PRECIPITATION.

At the opening of the month a well-defined storm was central over Tennessee, whence it moved east-northeastward to the vicinity of Newfoundland by the 3d, causing moderate precipitation in eastern districts, especially the lower Lake region and the central and northern portions of New York and New England. About three days later some additional precipitation occurred in the Northeast in connection with a storm that followed closely the northern border. In the Pacific Northwest considerable precipitation occurred about the 6th and again about the 13th.

Two well-marked storms moved eastward in central latitudes, one in the latter part of the first decade, and the other early in the second decade, causing light to moderate precipitation, fairly well distributed, in the regions east of the Mississippi River, with considerable snow in Michigan. Then about the 13th to 15th a large area of low pressure, that had no well-marked single center till it reached the Atlantic States, again brought rain over most sections east of the Mississippi River, with unusually heavy falls locally near the East Gulf coast.

On the morning of the 16th a vigorous storm center was over Kansas, whence it moved slowly northeastward to southern Ontario by the 19th. Decidedly heavy rains occurred in connection with this storm over Arkansas and a strip extending thence northeastward to southern Michigan and western Ohio. Cairo, Ill., recorded over 6 inches within 72 hours.

About this time and continuing well into the third decade there was widespread precipitation in far northwestern districts from northern Wyoming and central Montana westward, northern California receiving some. Wyoming, Idaho, and Montana had considerable snow, and some eastern parts of Washington and Oregon had unusual amounts for the region.

Light to moderate precipitation occurred in many northeastern districts during the early and middle parts of the final decade. On the 27th an energetic storm was central over the Ohio Valley, whence it moved eastward causing fairly well-distributed precipitation in States east of the Mississippi River, with heavy snows in northern New England and a very severe sleet and ice storm in southern New England. The Pacific States had much precipitation during the final week, especially the western counties of Washington.

The month as a whole had generally ample precipitation in regions east of the Mississippi River, the majority of States having more than the normal November amounts. There was likewise more than the usual November fall in the States from North Dakota and Wyoming westward. Precipitation was light and generally deficient in the upper Mississippi Valley, the Great Plains region, and the Southwest. Over large areas in the southern Plains there was practically no precipitation during the entire month and drought conditions were becoming serious.

#### SNOWFALL.

The total fall of snow during November was usually above the normal along the northern border States, particularly in northern New England, portions of the Great Lakes region, and generally over the far northwestern States. On the other hand, there was little snow from the Middle Atlantic States westward over the great central valleys, and the higher elevations of California, Arizona, Nevada, and New Mexico had amounts far less than the average November amounts.

Unusually heavy snow for November occurred on the 8th and 9th in portions of central-southern Michigan, where in the area of heaviest fall amounts up to nearly 20 inches were measured, the greatest depths ever reported in that section so early in the month. Also about the 18th to 20th unusually heavy snow occurred over portions of northern Oregon east of the Cascade Mountains and the adjacent sections of Washington and Idaho, the falls in some cases being the greatest of record for November, and nearly equaling the average annual fall.

## RELATIVE HUMIDITY.

The relative amount of moisture in the atmosphere was above the normal over the greater part of the country from the Missouri and Mississippi Valleys eastward, the excess being large in portions of the Appalachian Mountains and the adjoining districts where there was much cloudy, rainy weather. From Texas and the Middle Plains westward to the Pacific the relative humidity was usually much below normal.

## Severe local storms.

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau.]

Place.	Date.	Time.	Width of path.	Loss of life.	Value of property destroyed.	Character of storm.	Remarks.	Authority.
			Yards.					
Northern Ohio.....	1			3		Gale and rain.	Wires and trees down, cellars flooded, and transportation services interrupted; velocity of wind 54 miles.	Plain Dealer (Cleveland, Ohio).
New Orleans, La.....	13					Wind and thunder.	Some damage to roofs and buildings; electric and telephone systems out of commission in various parts of the city; 2 persons injured.	New Orleans Item (New Orleans, La.).
Reform, Ala., and vicinity...	18				\$5,000	Hail.	Severe damage to roofs, and windows; stones weighing 1 pound fell.	The Advertiser (Montgomery, Ala.).
Arkansas (Polk, Clark and Garland Counties).	17	P. m.	(1)	11		Tornadoes.	Homes and barns demolished, live stock killed; wire communication interrupted and much timber destroyed; 39 persons injured; damage estimated at thousands of dollars.	United States Weather Bureau official. Commercial Appeal (Memphis, Tenn.).
Rockport, Ind. (near).....	18	P. m.	1,700			Cyclone.	30 barns and 3 houses destroyed; damage estimated at from \$100,000 to \$150,000.	Evansville Courier (Evansville, Ind.).
Marshall, Tex. (few miles N. E. of).	18					Tornado.	Some property damage.	Official United States Weather Bureau.
Portland, Oreg.....	19, 20					Ice.	Train service blocked, lines, poles and trees down; thousands of phones out of service.	Do.
Boston and vicinity.....	27, 28, 29					do.	Telephone and electric companies sustain heavy losses; shade and ornamental trees destroyed or greatly damaged; damage to orchards is estimated at well over \$1,000,000.	Do.

<sup>1</sup> One hundred yards to one-half mile.

551, 515 (73)

## STORMS AND WEATHER WARNINGS.

EDWARD H. BOWIE, Supervising Forecaster.

## WASHINGTON FORECAST DISTRICT.

The month was a notable one for the number of areas of high and of low pressure to cross the Washington forecast district. For the country at large, 25 separate and distinct areas of low barometer appeared during the month, while as to areas of high barometer there were 14. Many of the lows had their origin in and were offshoots from the subpermanent low of the North Pacific, and have been classed as lows of either the Alberta or North Pacific type, from which there developed a considerable number of secondaries. There was but one low of tropical origin, and it was only of moderate intensity. It had its origin over the ocean somewhere east of the Bahamas and it disappeared over the southeastern portion of the Gulf of Mexico. The highs of the month did not bring unseasonable cold weather to the Washington forecast district, and the cold waves which occurred were confined to the northern border states.

A storm of considerable intensity was central the morning of the first day of the month over the central Ohio Valley, with the lowest barometer at its center 29.46 inches; moving eastward this disturbance passed off the middle Atlantic coast during the night of the 1st and thence followed a path east-northeastward toward the Grand Banks of Newfoundland. This disturbance was attended by strong northeast winds and gales on the lower Lakes and the North Atlantic coast, warnings of which were disseminated. On the 3d a disturbance made its appearance over the western Canadian provinces, ad-

vanced rapidly eastward along the northern border and reached the New England States on the 5th. On the 4th when this disturbance was crossing the Great Lakes, southwest storm warnings were displayed on Lakes Erie, Ontario, and southern Huron; the evening of the same day northwest storm warnings were displayed on the Atlantic coast at and north of Delaware Breakwater. This disturbance was attended by shifting gales in the regions where storm warnings were displayed, and it gained great intensity while moving from New England to Newfoundland. The highest velocity reported during the prevalence of this storm was 66 m. p. h. from the northwest on the 5th at New York City.

At 6 p. m. of the 7th, the following advisory information was sent to ports on the Great Lakes:

Western disturbance central at 4 p. m. over western Kansas will move eastward and probably gain in intensity, attended by fresh easterly winds becoming strong by Tuesday morning with rain and snow. Caution advised. Later information will be sent you to-night if any change indicated.

The 8 p. m. reports showed this storm to have moved to eastern Kansas; and as the pressure gradient was considerable in its northeast quadrant, northeast storm warnings were ordered displayed on southern Lake Michigan, and on the morning of the 8th the display of northeast storm warnings was extended to Lakes Erie, Ontario, and extreme southern Huron. The storm center passed south of the Great Lakes during the 8th, attended by winds of gale force at a number of Weather Bureau stations in the area where warnings were displayed. On the morning of the 9th its center was over Kentucky, and at the same time there were indications of the development of a secondary disturbance off the North Caro-